

Title : Grain-Size Distribution and Characteristics of Surface Sediment in Chanthaburi Estuary at Pak Nam Laem Sing and Bang Kachai Subdistricts, Laem Sing District, Chanthaburi Province

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ABSTRACT

Global sea-level rise induced by climate change has significantly affected coastal and estuarine systems, which are highly sensitive to variations in the hydrodynamic balance between fluvial and marine processes. The Chanthaburi Estuary, located in the Pak Nam Laem Sing and Bang Kachai Subdistricts, Laem Sing District, Chanthaburi Province, represents a dynamic transitional environment where tidal forcing, river discharge, and anthropogenic activities collectively influence sedimentary processes and spatial grain-size distribution. This study aims to analyze the spatial distribution and textural characteristics of surface sediments in the Chanthaburi Estuary and to investigate sediment transport dynamics using the Grain-Size Trend Analysis (GSTA) method. A total of fifteen surface sediment samples were collected using a systematic sampling design covering the spatial extent of the study area. According to the sediment classification system of Folk (1954), the dominant sediment type is gravelly muddy sand (gmS), accounting for 53.33% of the samples. Gravelly sand (gS), slightly gravelly sand ((g)S), and slightly gravelly muddy sand ((g)mS) each account for 13.33%, whereas gravelly mud (gM) represents 6.67%. The grain-size distribution results indicate that gravel-sized sediments are predominantly concentrated in the central part of the study area, reflecting high-energy conditions likely influenced by terrestrial

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input and anthropogenic activities, particularly agriculture in the middle estuarine zone. Sand-sized sediments are mainly distributed near the river mouth and estuary mouth, reflecting active hydrodynamic processes under moderate-to-high-energy conditions influenced by tidal and fluvial interactions. In contrast, silt-sized sediments increase with distance from the river mouth and estuary mouth, indicating a gradual reduction in hydrodynamic energy. Clay-sized sediments are commonly associated with silt in lower-energy depositional environments. The sorting (standard deviation) map indicates moderately sorted sediments near the estuary mouth, whereas other areas are classified as poorly to very poorly sorted. This pattern suggests mixing between terrestrial and marine sediment sources within the estuarine system. The skewness map further shows that sediments near the river mouth and coastal inlet are coarse-skewed, suggesting selective removal of fine particles under relatively high hydrodynamic energy. In contrast, other areas exhibit a tendency toward fine-skewed distributions, reflecting the presence of mixed fine-grained sediments under lower-energy depositional conditions. Morphological analysis reveals that 100% of the sediment grains are sub-rounded, indicating a moderate degree of transport maturity. In terms of sphericity, 86.67% of the grains exhibit low sphericity, while 13.33% show high sphericity, suggesting variable transport distances and depositional processes within the estuary. The results of the Flemming Diagram indicate that most samples are distributed within Zone I to Zone IV and are positioned far from the clay end member, suggesting relatively strong hydrodynamic conditions. Finally, the results of the Grain-Size Trend Analysis (GSTA) indicate that sediment transport vectors generally converge toward the central part of the estuary. This pattern suggests the presence of a sediment accumulation zone under the combined influence of fluvial discharge and tidal forcing, reflecting the dynamic interaction between river-dominated and tide-dominated processes within the estuarine system. The findings of this study provide essential baseline information for sustainable coastal and estuarine management, supporting future sediment management and shoreline conservation strategies under the conditions of ongoing sea-level rise and climate change.

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